EFFECT OF INTERCROPPING TEA WITH CLOVE ON SOIL MOISTURE STATUS

R, MATHAVAN
Department of Minor Export Crops Research Station, Matale, Sri Lanka.

H. P. M. GUNASENA
Dean, Faculty of Agriculture, University of Peradeniya, Sri Lanka.

and

K V, A. BAVAPPA
Director, Central Plantation Crops Research Institute, Kasaragod 670 124, Kerala, India.

SUMMARY

A study on soil moisture status was undertaken in the mixed and monocrop stands of about one hundred years old seedling tea and clove. Moisture in the first 30 cm soil depth during the peak drought was roughly 18% for monocrop of tea and in clove it was about 29% in the mixed stand. The moisture in the subsequent depths was also high in the mixed stand than in the mono stand. Thus, compared to monocrops of both tea and clove there was a higher percentage available moisture in the mixed stand of these two crops at all three soil depths.

Although the percentage available soil moisture was higher at points of less root concentration in the monocrop of clove and the mixed crop, soil under mixed crop with high root concentration was always higher in moisture than the monocrops.

Introduction

Mid country of Sri Lanka covers wide a area, north-west of Dimbula - Hatton basin towards Kandy and in the lower central and northern parts of the Uva basin of elevation between 610 - 1220 m accounts for 38% of the area and 33% of the production of tea. Rainfall is the major determinant of the distribution of production and the quality of the product in tea which are seriously affected by occasional drought in these areas and makes tea marginal crop.

Clove is being interplanted in the mid country tea lands for additional remuneration against low level of productivity of tea. Not only the reduction in tea yield is compansated by the high cash value of clove as evident from the net return of Rs. 57,000/ha from the mixed crop of tea and clove as against Rs. 5,900/ha of monocrop of tea (Van Tilburg, 1981)

but also the simulation of a favourable ecoclimate (Balakrishnan *et al*, 1976) in the canopy atmoshere, which could reduce evapotranspiration loss of soil moisture and minimise the effect of occasional drought in the mid country tea lands This study has been designed to understand the effect of intercropping tea lands with clove, on soil moisture status.

MATERIALS AND METHODS

Percentage of available soil moisture in the soil under mono and mixed crops of tea *Camellia sinesis* (L). O. Kuntze, (Sealy, 1958), clove, *Eugenia caryophyllus*. Bullock *et* Haerison, (Bullock and Harrison, 1958) and in the open were monitored on alternate days at depths of 15, 45 and 75 cm for a period of four months from 9 January to 29 April 1981. This experiment was carried out at the State Plantation, Hunnasgiriya, Sri Lanka, which is 800 m above mean sea level where (15 years old) clove has been inter planted at the distance of 6 m with (about 100 years old) seedling tea planted one metre apart. Monocrops of clove and tea of similar ages planted in the same estate, were also used in the study.

The observations from February 10th to March 6th, which represented the dry period were used for critical study of moisture.

In clove monocrop and in tea – clove mixed crop the measurements were taken at three different distances from clove (Viz 30 cm, 120 cm and 270 cm), while in the bare soil and tea monocrop the measurements were made only at one point. The observations were made at eight locations in each of the systems. Gypsum blocks were buried at respective points of measurement of soil moisture and the percentage available moisture was monitored using Bouyoucos moisture meter on alternate days.

The data on fresh weight, number of branches and length of roots in a unit volume of soil at distances 1.2 m and 2.7 m away from clove in the mixed crop as well as monocrop of clove for three soil depths were obtained using "root excavation method" (Mathavan, 1982).

RESULTS

Monocrop stand of clove and mixed stand of tea and clove :–

The rate of depletion of soil moisture levels in the root zone of mixed crops of clove and tea, monocrop of clove and bare land are given in Figs. 1, 2 and 3. The percentage available soil moisture was higher in the mixed crop than in the monocrop of clove. This trend was seen at all three soil depths.

Initially the bare land had higher percentage available moisture than the cropped land. However, there was a sharp depletion of moisture in the upper soil layer which brought down the level to below that of cropped land. This was not observed in the subsequent soil depths.

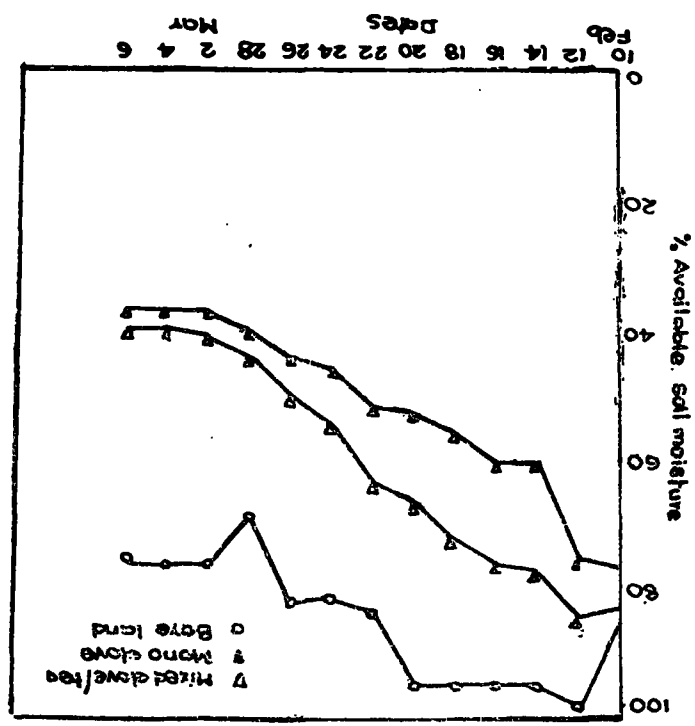

Fig. 1 % Available soil moisture at different periods for mixed stand of clove and tea, mono stand of clove and bare land (0–30 cm soil depth)

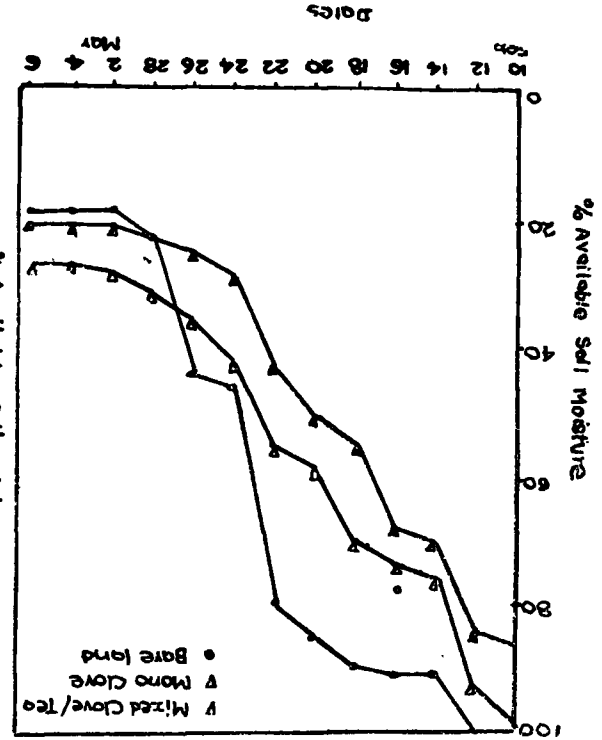

Fig. 2 % Available soil moisture at different periods for mixed stand of clove and tea, mono stand of clove and bare land (30–60 cm soil depth)

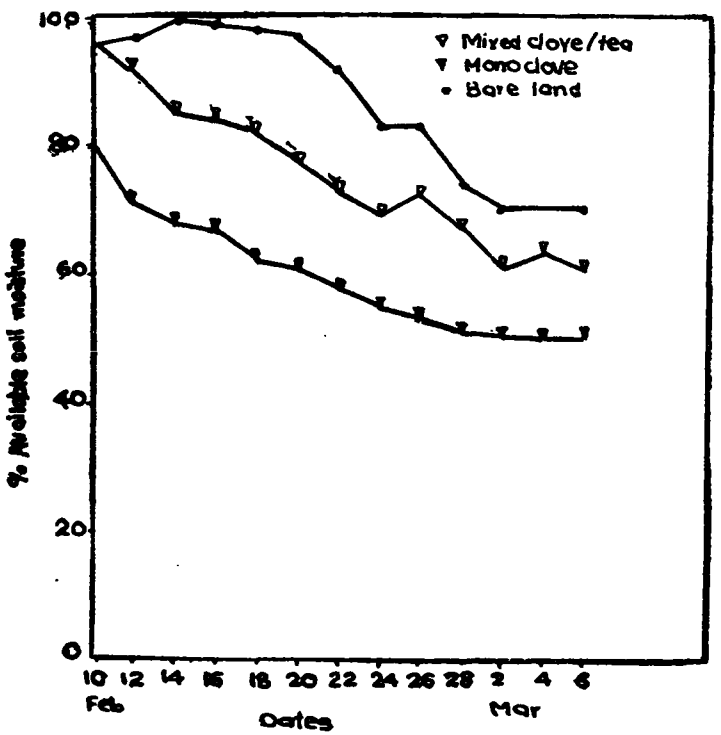

Fig. 3 % Available soil moisture at different periods for mixed stand of clove and tea, mono stand of clove and bare land (60–90 cm soil depth)

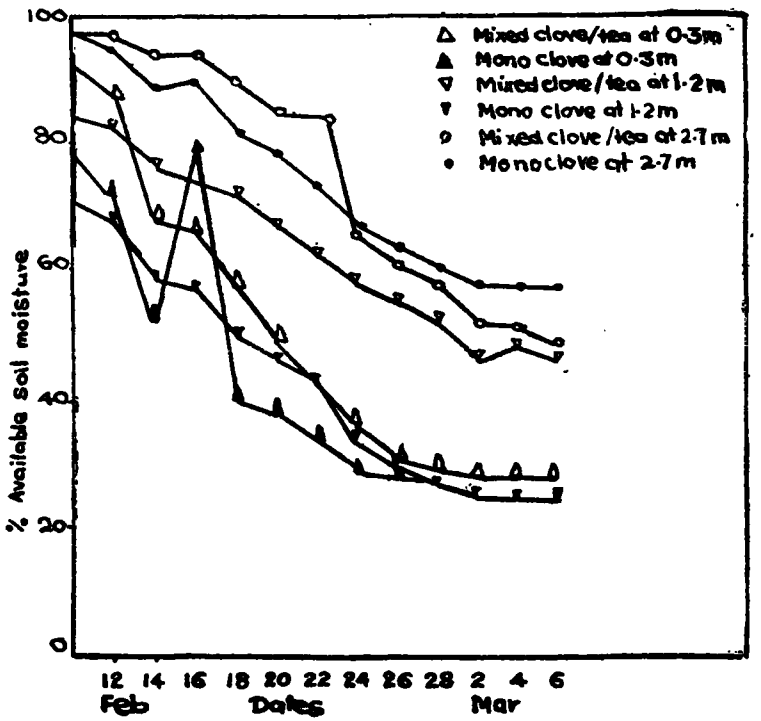

Fig 4 % Available soil moisture at different periods for mixed stand of clove and tea at three distances from clove

The soil moisture levels at different root zone distances (Viz. 1.2 m and 2.7 m) and depths (Viz. 15 cm, 45 cm and 75 cm) in the mixed crop of clove and tea and monocrop of clove are given in Table 1 and Fig. 4. The data on fresh weight, number of branches and length of roots in a unit volume of of soil at the above distances and depths are presented in Tables 2, 3 and 4. It was seen that the percentage available moisture was higher at the farther point from the clove which had a lower root concentration. This was seen at all three depths.

TABLE 1 Percentage Available Soil Moisture at Peak Drought (06.03.1980) for Monocrop of Clove and Mixed crop of Tea and Clove at Different Distances and Soil Depths

Soil Depth cm	At 1.2 m from Clove		At 2.7 m from Clove	
	Mixed Tea + Clove	Mono Clove	Mixed Tea + Clove	Mono Clove
0 – 30	28.9	17.5	33.9	26.5
30 – 60	46.5	26.8	41.0	30.4
60 – 90	70.7	67.5	69.0	83.3

TABLE 2 Fresh Weight of Roots in 3 m cube Soil of Mass in Mixed Stand of Clove and Tea and Mono Stand of Clove (Kg) at 1.2 m and 2.7 m Distance from Clove Plant

Depth (cm)	Mono Crop (Clove)		Mixed Crop Tea + Clove	
	1.5 m	2.7 m	1.2 m	2.7 m
0 – 30	14.5	3.8	328.6	90.7
30 – 60	8.5	3.1	120.1	32.6
60 – 90	8.5	0.7	38.5	4.0

TABLE 3 Number of Branches of Roots in 3 m cube of Soil Mass in Mixed Stand of Clove and Tea and Mono Stand of Clove at 1.2 m and 2 7 m Distances from Clove Plant (Ne. × 1000)

Depth (cm)	Mono Crop (Clove)		Mixed Crop Tea + Clove	
	1.2 m	2.7 m	1.2 m	2.7 m
0 – 30	1.01	0.23	2.23	1.10
30 – 60	0.51	0.15	0.68	0.40
60 – 00	0.30	0.04	0.37	0.19

TABLE 4 Length of Roots in 3 m cube of Soil Mass in Mixed Stand of Clove and Tea and Mono Stand of Clove at 1.2 m and 2.7 m Distance from Clove Plant (m)

Depth (em)	Mono Crop (Clove)		Mixed Crop Tea + Clove	
	1.2 m	2.7 m	1.2 m	2.7 m
0 - 30	1.94	0 5	5.21	1.59
30 - 60	1.29	0.38	1.32	0.7
60 - 90	0.8	0.09	0.76	0.3

Monocrop stand of tea and mixed stand of tea and clove:-

The pattern of soil moisture changes in a dry period in monocrop stand of tea, mixed stand of tea and clove and bare land is shown in Figs 5, 6 and 7. The percentage available soil moisture in the monocrop of tea and mixed crop of tea and clove did not vary widely in the early dry period. However, in the monocrop, the moisture level sharply drops towards the latter period of the drought to a level lower than that of mixed stands

Moisture at different depths in different crop combinations :-

The data on percentage of available soil moisture at peak drought at different soil depths for monocrops of clove and tea, their mixed stands and bare land are given in Table 5. It was observed that when the land was cropped, soil moisture under mixed stands was higher at all depths compared to monocrops.

TABLE 5 Percentage Available Soil Moisture at Peak Drought (06.03.1980) at Different Soil Depths in Different Cropping Systems.

Soil depth	Bare Soil	Mono Crop		Mixed Crop
		Clove	Tea	Tea + Clove
0 - 30 cm	18.5	17.5	18.7	28.9
30 - 60 cm	76 4	26.8	33.7	46.5
60 - 90	70.4	67.5	57.8	70.7

The data on soil moisture levels at different soil depths for mixed and monocrop stands of clove and tea and bare soil for a continuous drought period are shown in Figs. 8, 9, 10 and 11. It was seen that the percentage of available moisture was higher in the soil layers than in the upper layers in all the cases.

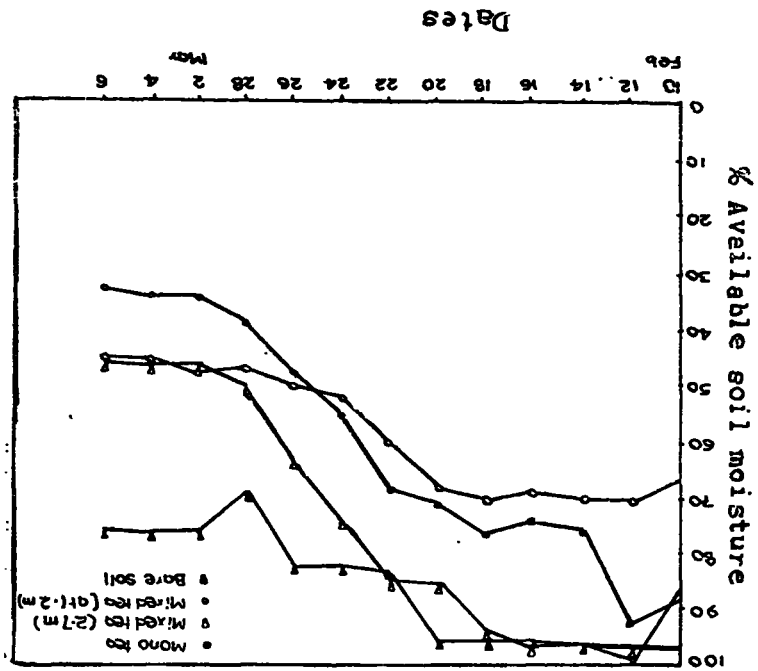

Fig. 5 % Available soil moisture at different periods for mixed stand of clove and tea (at two distances from clove) mono stand of tea and bare soil (0–30 cm soil depth)

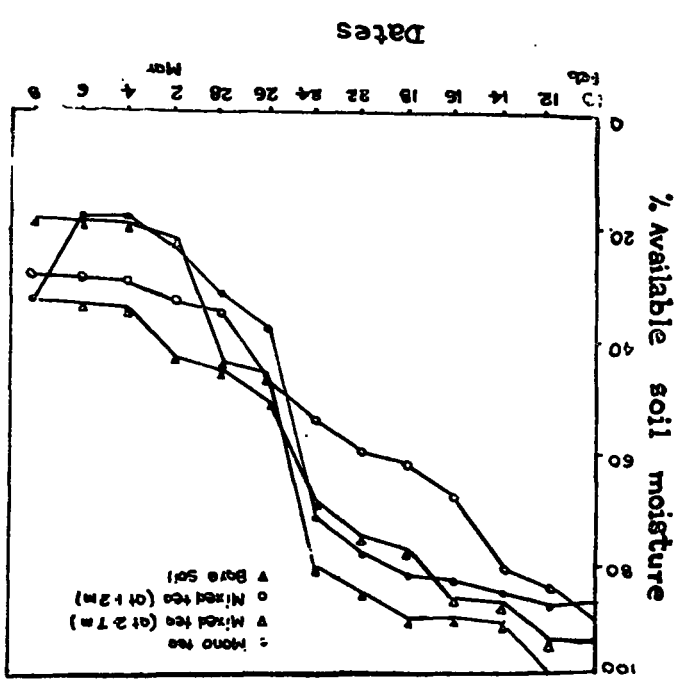

Fig. 6 % Available soil moisture and time for mixed stand of clove and tea (at two distances from clove) mono stand of tea and bare soil (30–60 cm soil depth)

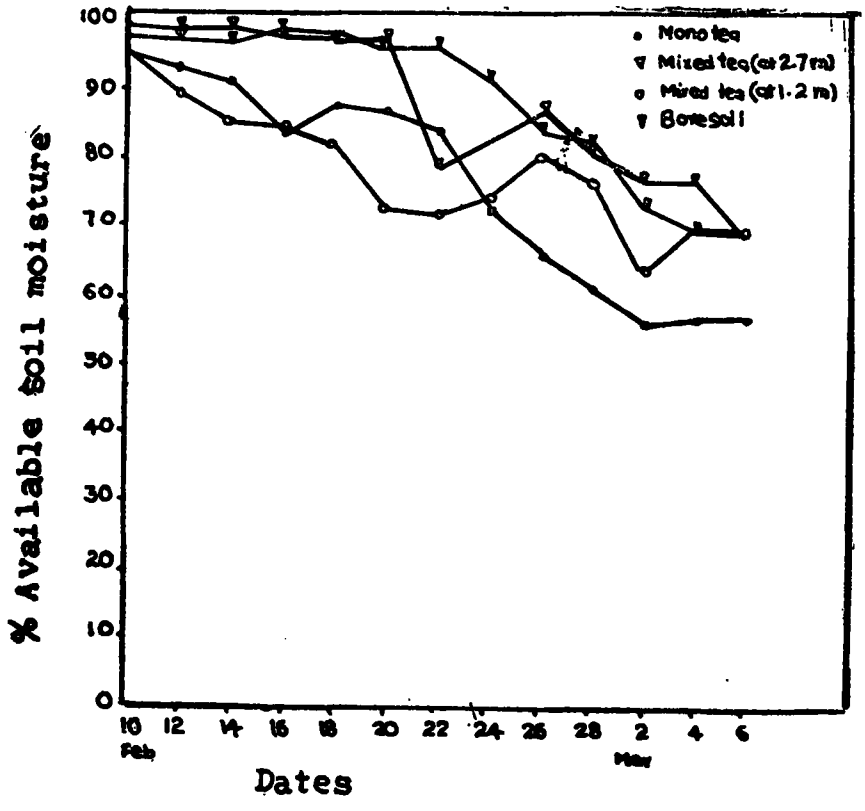

Fig. 7 % Available soil moisture and time for mixed stand of clove and tea (at two distances from clove) mono stand of tea and bare soil (60-90 cm soil depth)

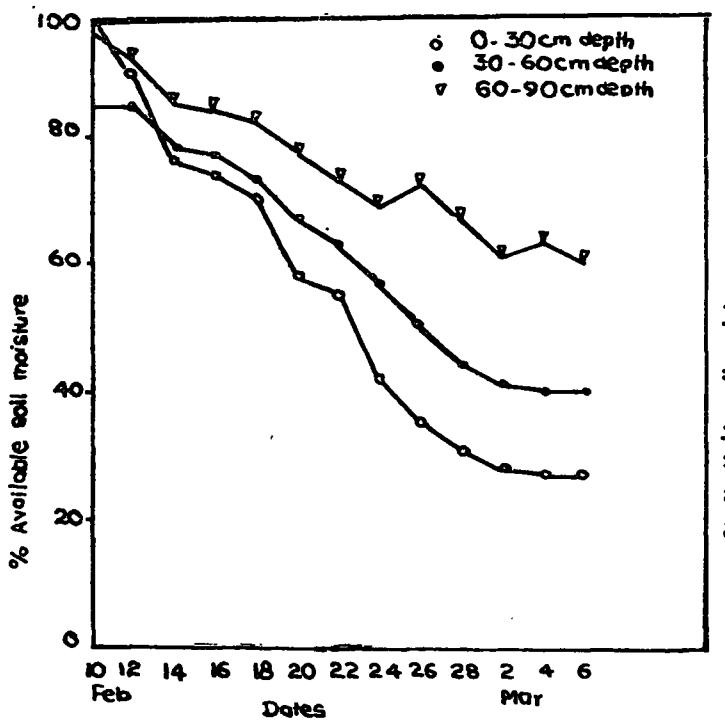

Fig. 8 % Available soil moisture at different periods for mixed stand of clove and tea at three soil depths (mean of three distances from clove)

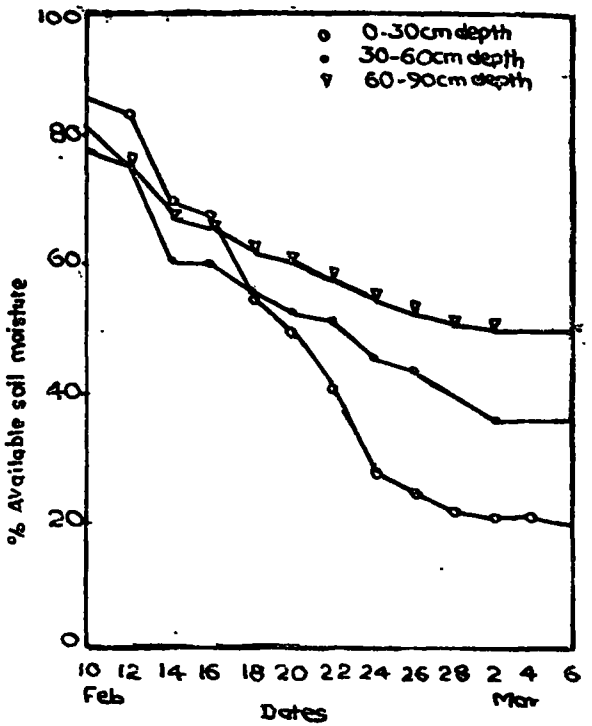

Fig. 9 % Available soil moisture at different periods for mono stand of clove at three soil depths

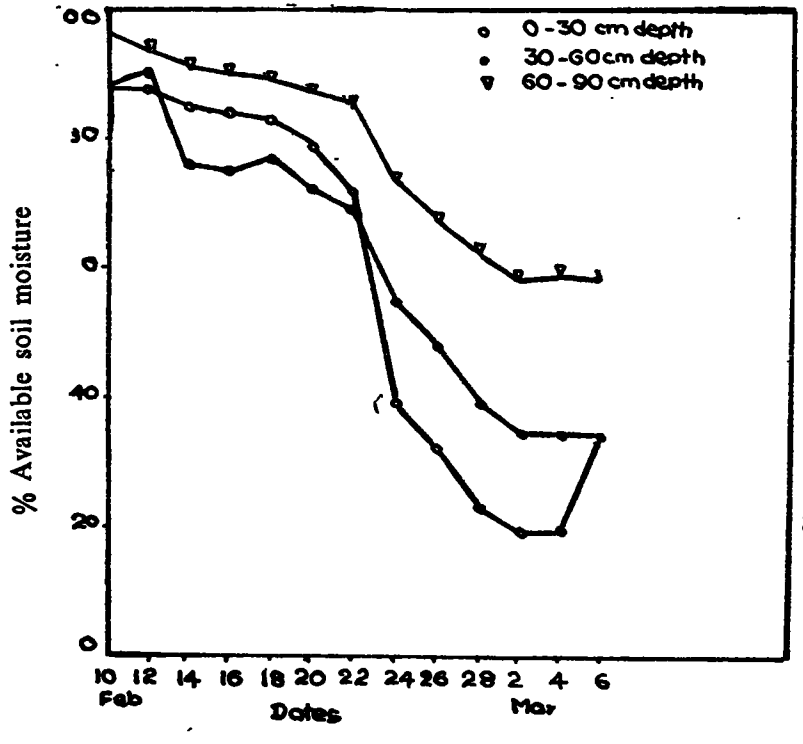

Fig. 10 % Available soil moisture at different periods for mono stand of tea at three soil depths.

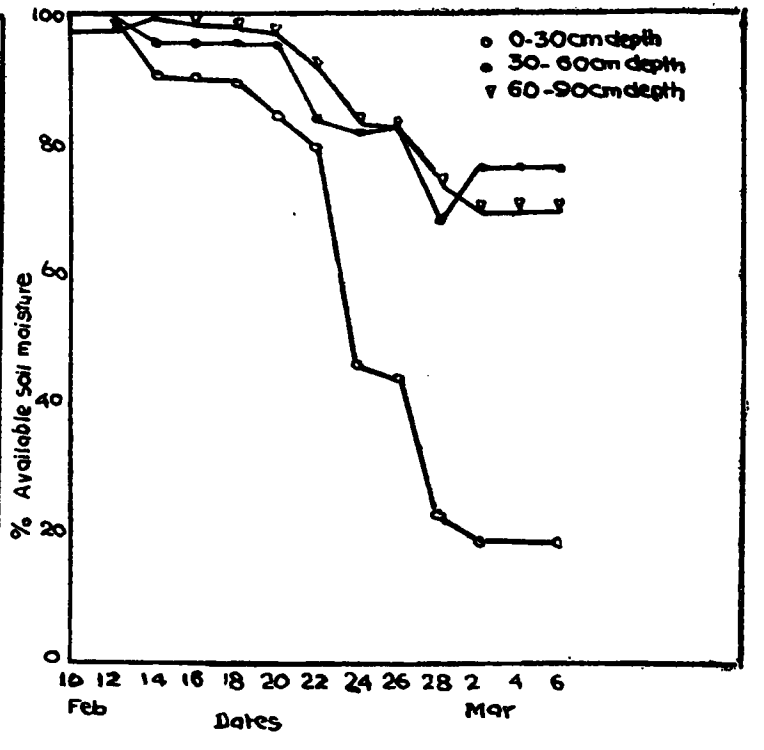

Fig 11 % Available soil moisture at different periods for bare soil at three depths

DISCUSSION

Soil moisture studies have shown that compared to monocrops of both tea and clove there was higher percentage available moisture in the mixed stand of these two crops at all three depths (Table 5). Nair and Balakrishnan (1977) observed that under the mixed stands of cacao and cononut shading reduced air temperature in the crop combination and caused considerable reduction in the rate of evaporation in the ecoclimate. A similar situation appears to exist in the tea-clove mixed cropping system in which the shade provided by clove to tea can possibly help to keep the soil temperature and evaporation low. Since tea forms the major component of mixed crop, such a reduction can considerebly help to conserve the soil moisture.

Moisture in the first 30 cm soil depth during the peak drought was roughly 18% for monocrops of tea and clove while this was about 29% in the mixed stand. At the peak drought period when the moisture in the monocrops and the bare soil was rapidly depleted and fell almost close to the wilting point, the higher moisture level observed in the mixed crop is a definite advantage in the survival of the crops It is not only the higher moisture in the top soil depth but also the higher moisture in the lower depths observed in the mixed crop which can help these crops in the drought situations since both these had nearly 33% of their roots also in the lower depths (Mathavan, 1982).

The root concentration of tea and clove had been found to be higher at 1.2 m away from clove in the tea-clove mixed stand and in the monocrop of clove than at 2.7 m. Percentage of available moisture at these two distances also have shown a more or less inverse reduction, the level of moisture at 1.2 m being less than that at 2.7. This is understandable since a larger number of roots at any given point can be expected to draw higher quantities of moisture from the given zone. However, such a situation at certain points in the upper 30 cm soil has not affected the overall moisture availability. It is apparent that mixed stand of tea and clove has positive advantages to both the crops as far as soil moisture availability is concerned.

Acknowledgements

Authors thank Dr. S. T. W. Kirinde, Director and Dr. W. S. Alles, former Assistant Director (Research) of the Department of Minor Export Crops for their keen interest and encourgement in this work. We are greatly indebted to the Natural Resources, Energy and Science Authority of Sri Lanka for financial support.

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